

# **Air Force Domain Analysis JSIMS Domain Engineering Teams Update**



**USAF ESC/AVM  
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## Overview

- **Background**
- **Conceptual Models (Structure and Syntax)**
- **Air Force Domain Analysis**
- **Examples of AF Domain Models in progress for NASM**
- **The RDD-100 Systems Engineering Tool**



## Background

- **Conceptual Models are the first abstraction of the real world:**
  - **they MUST facilitate communication between Subject Matter Experts (SMEs) and Simulation Developers**
  - **they MUST be simulation and simulation method independent (i.e. they must support the development of either process oriented or object oriented simulations)**



## Background

- **Combat Models and Simulations are a representation of highly coupled, complex processes that are performed by multiple, heterogeneous (yet interacting) systems**
- **The basic or core processes in combat are relatively stable**
- **The systems that make combat processes a reality are often interchangeable and constantly changing**

**Conceptual Models of combat should focus on the combat processes -- letting these drive the object classification and object models**

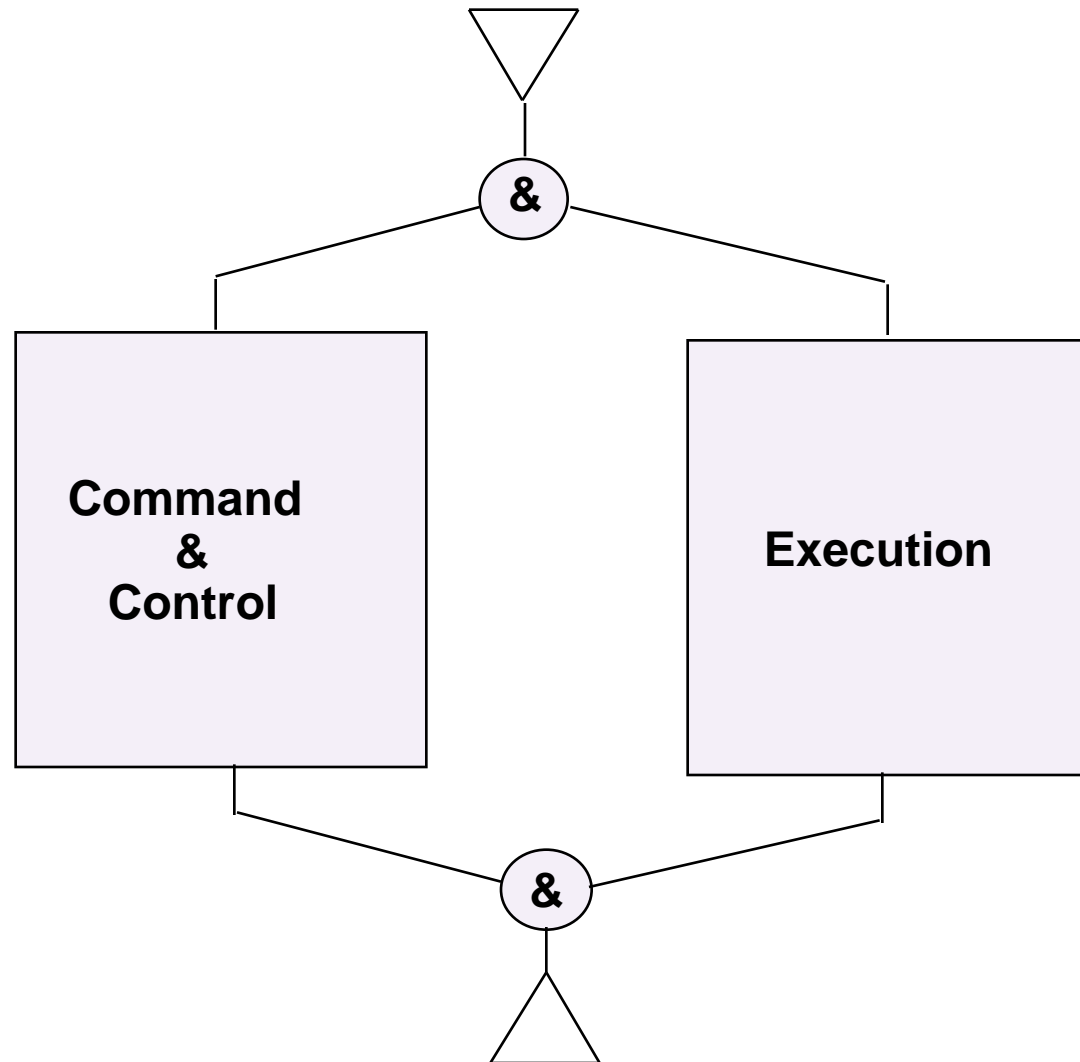


# The Modeling Process

- **The Team**
  - **SME**
  - **Systems Engineer**
- **Tools**
  - **Common structure (CMODSIM)**
  - **Common semantics**
  - **System Engineering tool(s)**
- **References**
  - **SME's knowledge**
  - **Doctrinal sources**
- **Validation**
  - **Workshops**
  - **Visits**
  - **WWW access for reviewers**



# Conceptual Model of Simulation





## CMODSIM

**Describes behavior during air combat and combat support operations:**

- **Command and Control (Cognitive Processes)**
  - National Strategic
  - Theater Strategic
  - Theater Operational
  - Tactical
  - System
- **Execution (Physical Processes)**
  - Communicate
  - Sense
  - Move
  - Engage



# Common Structure and Semantics

## Conceptual Model of Command and Control (CMODC2)

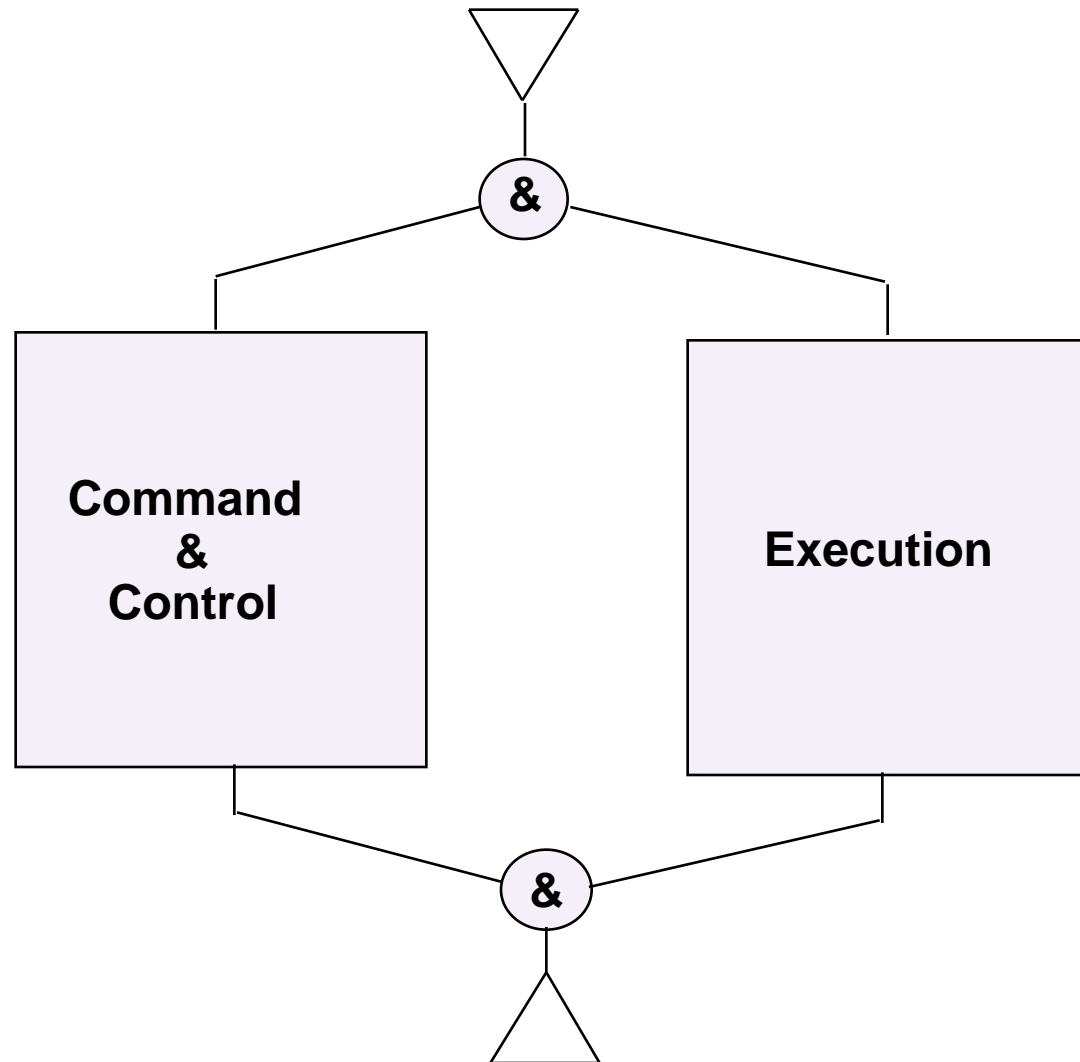


- **Common semantics provides systematic use of verbs**
- **CMODC2 provides common structure for information integration in Knowledge Acquisition process**
  - **Brings different Subject Matter Experts (SMEs) with different experiences back to common reference point**





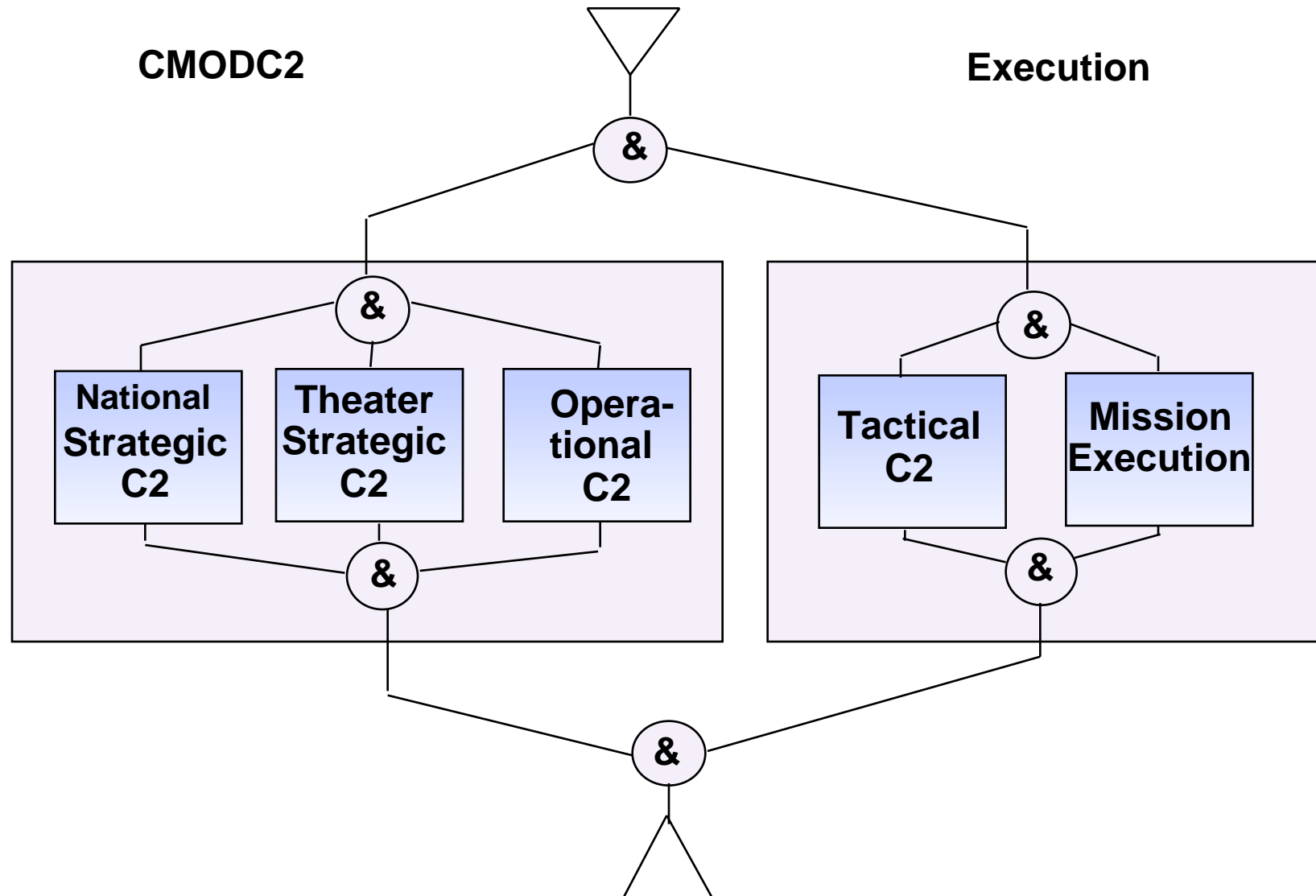
# CMODSIM



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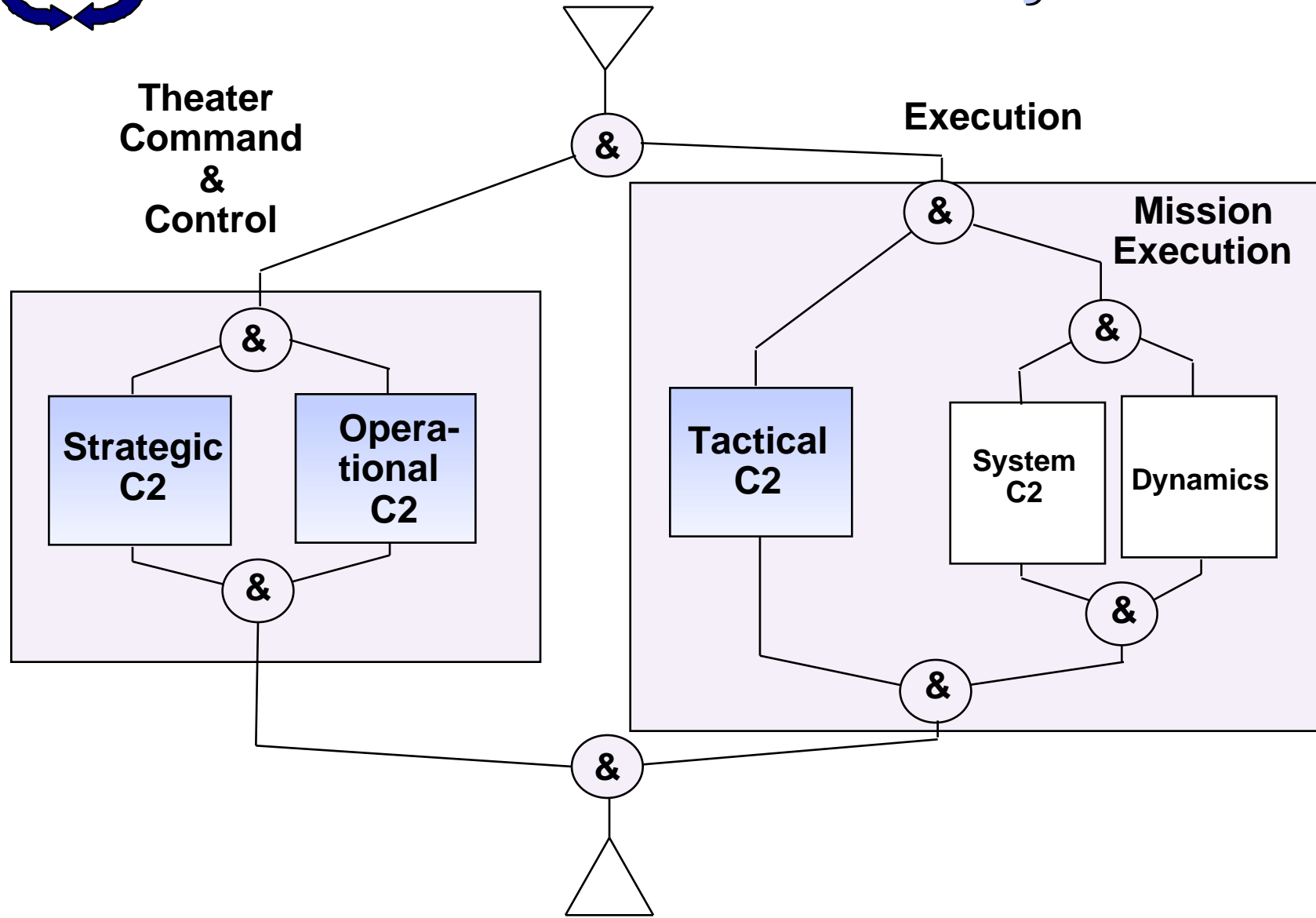


# Air Force Domain Analysis



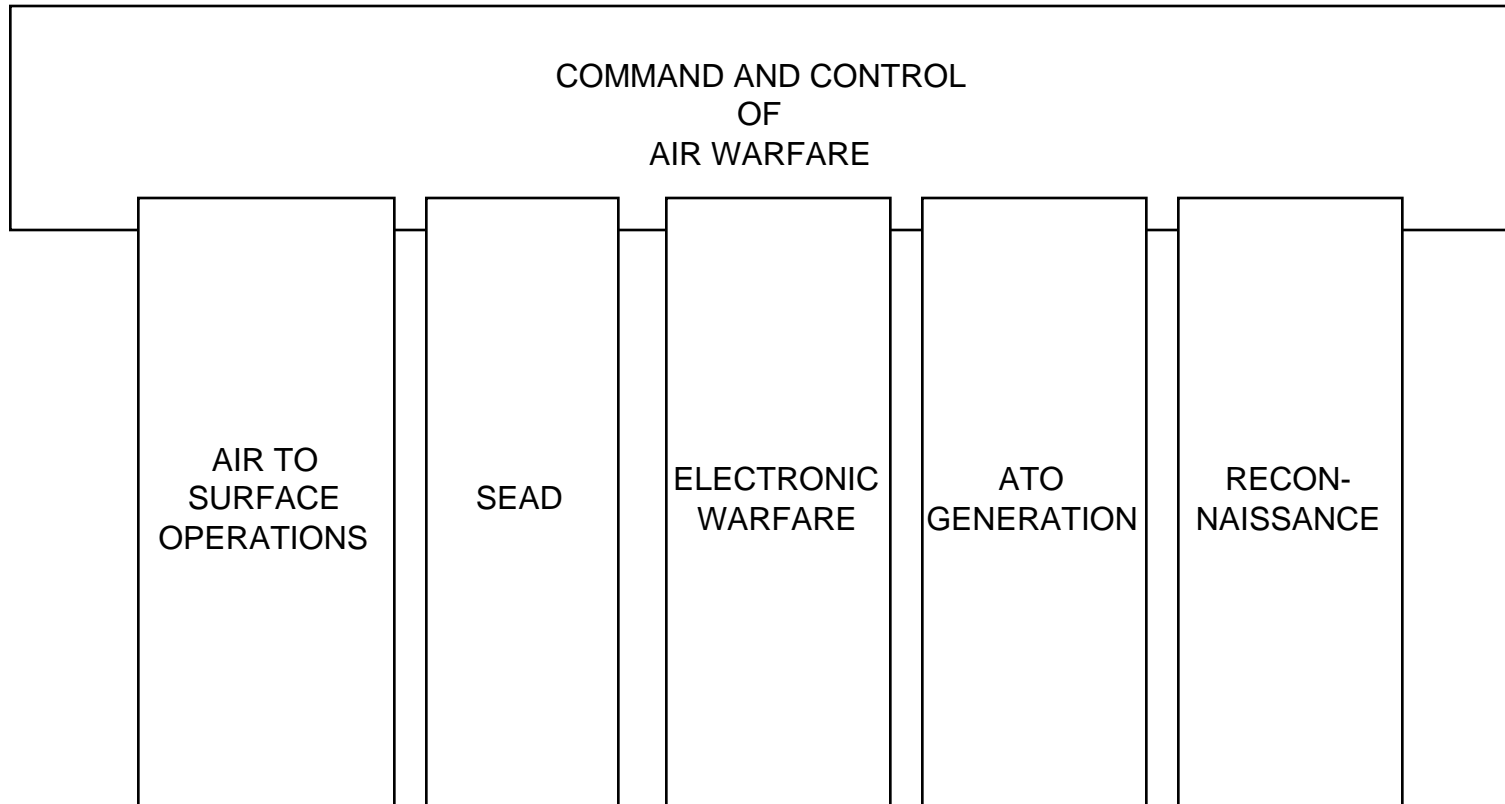


# Air Force Domain Analysis





## Mission Space is comprised of Missions



**Incrementally fill out the mission space until all AFM 1-1 missions are represented, including OOTW**



# Air Force Domain Analysis

## Illustrative Common Semantics for AF Domain Analysis Command and Control

### · Gather Information

- Gather
- Classify
- Highlight
- Find
- Combine
- Merge
- Parse
- Sort
- Check
- Receive
- File
- Catalogue

### · Review/Assess Requirements and Resources

- Identify
- Determine
- Restate
- Prioritize
- Estimate
- Analyze
- Review
- Update
- Prepare



# Air Force Domain Analysis

## Illustrative Common Semantics for AF Domain Analysis

### Command and Control

#### - Prepare Alternative Plans

- Develop
- Recommend
- Process
- Array
- Detail
- Compare
- Examine
- Contrast
- Investigate
- Assess
- Integrate
- Plan
- Match
- Calculate

#### - Direct Operations

- Choose
- Command
- Evaluate
- Issue
- Implement
- Direct
- Redirect
- Allocate
- Apportion
- Assign
- Appoint
- Control
- Decide
- Secure
- Order
- Give
- Coordinate
- Approve
- Select
- Acquire
- Obtain



# Air Force Domain Analysis

## Illustrative Common Semantics for AF Domain Analysis Command and Control (Multiuse)

- Screen
- Integrate
- Initiate
- Determine
- Restate
- Determine
- Identify
- Study
- Update



# Air Force Domain Analysis

## Illustrative Common Semantics for AF Domain Analysis Dynamics

- **Execute Combat**

- **Sense**

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- **Move**

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- **Engage**

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- **Communicate**

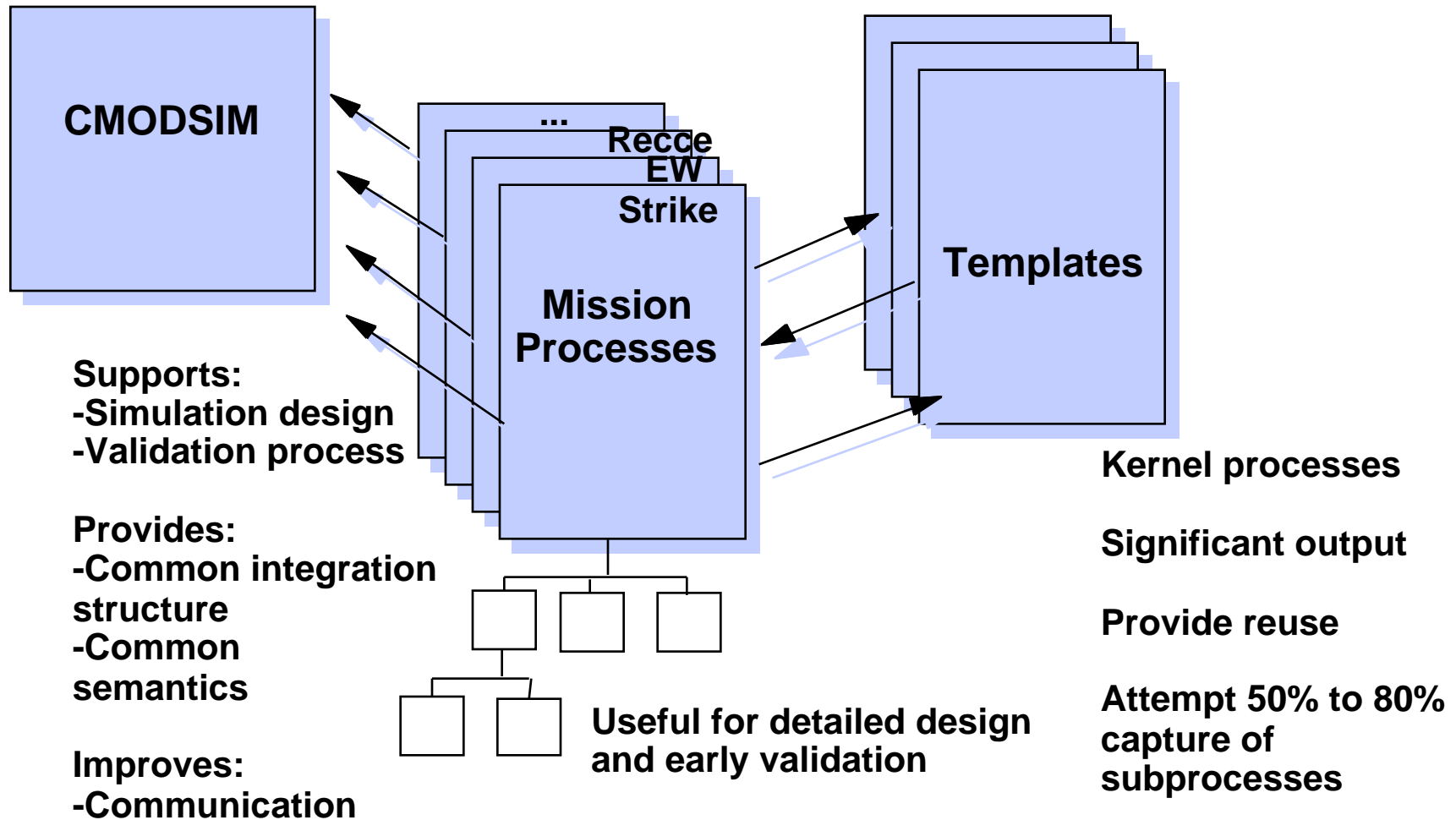
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# Conceptual Models





# Air Force Domain Model Example (draft)

**The Command Joint Forces CMODSIM and ATO generation process**

**See attached postscript files for these behavior diagrams:**

**CJF\_1.ps (Perform Military Operations--Level 0 view)**

**CJF\_2.ps (Command and Control Military Forces--Level 1 view)**

**CJF\_3.ps (Operational Command and Control for Theater Joint Forces--Level 2)**

**CJF\_4.ps (COA Development--Operational--Level 3)**



# Air Force Domain Model Example (draft)

**The generic mission take-off to landing process (template)**

**See attached postscript files for these behavior diagrams:**

**MSN\_1.ps (Generic Air Mission: Takeoff to Landing--Level 0 view)**

**MSN\_2.ps (Execute Air Operations--Level 1 view)**

**MSN\_3.ps (Perform Air Mission--Level 2)**



# Air Force Domain Model Example (draft)

## Tactical Airlift Mission

See attached postscript files for these behavior diagrams:

TALFT\_1.ps (Provide Theater Airlift--Level 0 view)

TALFT\_2.ps (Airlift Execution--Level 1 view)

TALFT\_3.ps (Tactical Command and Control--Level 2)



## RDD-100's Current Object View

- **Support for Object Types is provided in multiple views**
  - Object editing and browsing
  - Classification view
  - Composition view
  - Association view
- **The Integrated System Model is developed in different perspectives, including ...**
  - Real World Object perspective, specifying inheritance and processes
  - Behavior Model perspective, specifying external, observable behavior of processes
- **Object are then used in different Integrated System Models**
- **RDD-100 handles the management of originating and derived requirements**



## Ascent Logic's Plan for RDD-100's Object View

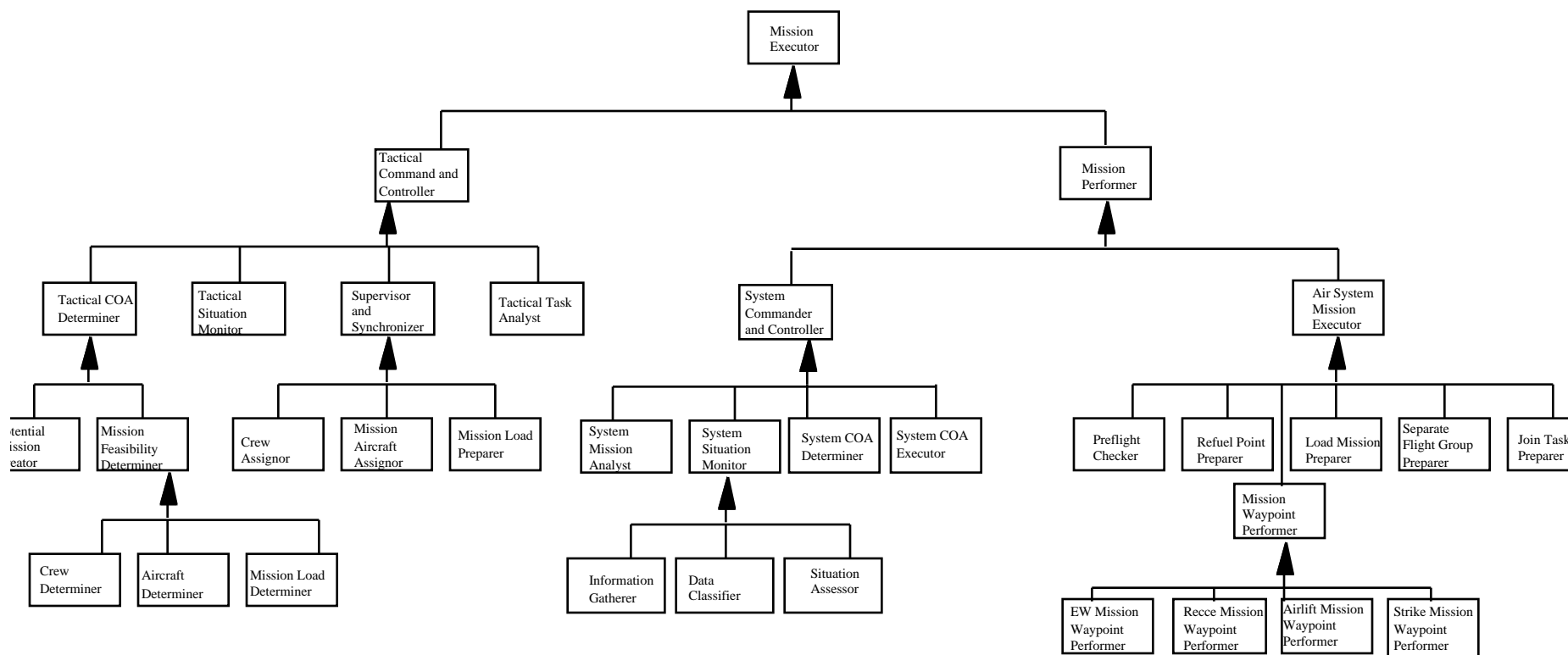
- **An Object-Oriented System Engineering methodology that defines the system (or process) as a collection of collaborating (interacting) objects that achieve a common purpose**
- **Uses “Best of Class” OO representation:**
  - **Rumbaugh's Object Structure notation**
  - **Jacobson's Use Case representation to behavior**
  - **Odell's representation for information engineering**
- **Commitment to support the leading industry methodology as the market demands it**
- **Currently found to be extremely compatible with the Unified Method**
- **Fundamentally based on OO database management; capable of evolution consistent with this paradigm**



# Examples of Object Classes in the Unified Method

Derived from the Behavior Diagrams in the examples shown

Generic Air Mission Object Inheritance Diagram





## Added Value of Behavioral Diagrams

- **Enhanced user manuals**
- **Configuration management**
- **Model/Simulation V&V**
- **Simulation migration management**





## Conclusions

- **CMODC2 and common semantics effort at GMU well underway**
  - starting point for CMMS Technical Framework effort on syntax and semantics at DMSO
- **NASM Air Force Domain Analysis**
  - developed template for mission execution
  - CMODSIM for C2 processes from NCA to tactical units with emphasis on JFACC processes
  - Tactical Airlift CMODSIM in validation
- **CMODSIM robust**
  - not Service or force type specific
  - using for Army and AF Domain Analysis



# Conclusions

- **Validation process starting**
  - **Systems Engineering Notebooks (SENs) available**
    - works in progress
    - frequent updates
  - **WWW distribution of Domain Models**
  - **validation workshops**
  - **validation visits with warfighters and simulation development community**